

What is claimed is:

1. A method for routing a data packet from a forwarding router to a downstream router comprising the steps of:

- (a) providing the data packet with a header including an address, said address including at least one bit string;
- (b) providing the forwarding router with a database including a plurality of prefixes;
- (c) looking up, via a first data structure in said database of the forwarding router, said prefix that best matches said bit string of said address of the data packet; and,
- (d) attaching a clue that is related to said best matching prefix to the data packet.

2. A method as in claim 1 wherein said attaching of said clue includes the writing of said clue into said header of the data packet.

3. A method as in claim 1 wherein said address of the data packet is selected from a group consisting of destination address of the data packet, source address of the data packet, destination port of the data packet, source port of the data packet and protocol of the data packet.

4. A method as in claim 1 further comprising the steps of:

- (e) providing the downstream router with a database including a plurality of prefixes;
- (f) forwarding the data packet with said clue by the forwarding router to the downstream router; and,
- (g) looking up, via a second data structure in said database of the downstream router, said prefix that best matches said bit string of said address of the data packet, said looking up being effected with reference

to said clue.

5. A method as in claim 1 wherein said clue is selected from the group consisting of
- (i) a bit string of said prefix of said forwarding router that best matches to bit string of said address of the data packet,
  - (ii) a number of bits in said bit string of said one best matching prefix and
  - (iii) a prefix associated with a point in said first data-structure of said forwarding router in which said looking up was terminated.

6. A method as in claim 1 wherein said looking up via said first data structure is effected by a method selected from the group consisting of Trie lookup, Patricia, binary search, 6 way search and fast binary search.

7. A method as in claim 4 wherein said looking up via second data structure is effected by a method selected from the group consisting of Trie lookup, Patricia, binary search, 6 way search and fast binary search.

8. A method as in claim 4 further comprising the step of:
- (h) deciding according to said clue, whether to continue said looking up in said second data structure of said downstream router.

9. A method as in claim 8 wherein said deciding precedes said looking up in said second data structure.

10. The method as in claim 8 wherein; if said decision is positive, said looking up begins at a vertex in said second data structure.

11. The method as in claim 10 wherein said vertex is associated with a binary string identical to a bit string of said prefix in forwarding router that best matches said bit string of said address of the data packet.

12. The method as in claim 10 further comprising the step of:

- (i) If said looking up fails, assigning one of said prefixes in said second database as a best matching prefix to said address.

13. The method as in claim 12 wherein said one assigned prefix is selected from the group consisting of

- (i) said clue,
- (ii) a prefix in a prefixed vertex representing said clue and
- (iii) a prefix in a prefixed vertex which is a nearest ancestor to a vertex representing said clue.

14. The method as in claim 8 further comprising the step of:

- (i) if said decision is negative, choosing one of said prefixes in said second data base of said downstream router to represent a best matching prefix to said address of the data packet.

15. The method as in claim 14 wherein said one chosen prefix is selected from the group consisting of

- (i) said clue,
- (ii) a prefix in a prefixed vertex representing said clue and
- (iii) a prefix in a prefixed vertex which is a nearest ancestor to a vertex representing said clue.

16. The method as in claim 4 further comprising the steps of:

- (j) constructing a hash table in the downstream router, said hash table including an indexed list of possible clues that the downstream router may receive.

17. The method as in claim 16 wherein each entry of said indexed list including:

- (i) a pointer field; and
- (ii) a final decision field.

18. The claim 17 wherein said list of said possible clues is prepared prior to said forwarding.

19. A method of routing a plurality of data packets from a forwarding router to a downstream router, comprising the steps of:

- (a) providing each data packet with a header including an address, said address including at least one bit string;
- (b) providing the forwarding router with a forwarding database including a plurality of prefixes; and
- (c) for each data packet:
  - (i) looking up, in said forwarding database, said prefix that best matches said bit string of said address of said each data packet, and
  - (ii) attaching to said each data packet a clue that is related to said best matching prefix.

20. The method of claim 19, further comprising the steps of:

- (d) providing the downstream router with a downstream database including a plurality of prefixes; and
- (e) for each data packet:
  - (i) forwarding said each packet with said clue thereof by the forwarding router to the downstream router; and
  - (ii) looking up, in said downstream database, a prefix that best matches said bit string of said address of said each data packet, said looking up being effected with reference to said clue of said each data packet.

21. The method of claim 20, further comprising the step of:

- (f) constructing a hash table in the downstream router, said hash table including an indexed list of possible clues that the downstream router may receive.

22. The method of claim 21, wherein each entry in said list includes:

- (i) a pointer field, and
- (ii) a final decision field.

23. The method of claim 21, further comprising the step of:

- (g) for each data packet: subsequent to said forwarding, updating said hash table, based on said clue of said each data packet.

24. The method of claim 23, wherein said updating is effected by steps including processing said clue of said each data packet with a hash function.

25. A method of routing a plurality of data packets from  $d$  forwarding routers,  $d$  being an integer greater than one, to a downstream router, each data packet being routed

from a respective forwarding router to the downstream router, the method comprising the steps of:

- (a) providing each data packet with a header including an address, said address including at least one bit string;
- (b) providing each forwarding router with a respective forwarding database including a plurality of prefixes; and
- (c) for each data packet:
  - (i) looking up, in said respective forwarding database, said prefix that best matches said bit string of said address of said each data packet, and
  - (ii) attaching to said each data packet a clue that is related to said best matching prefix.

26. The method of claim 25, further comprising the steps of:

- (d) providing the downstream router with a downstream database including a plurality of prefixes; and
- (e) for each data packet:
  - (i) forwarding said each data packet with said clue thereof by the respective forwarding router to the downstream router; and
  - (ii) looking up, in said downstream database, a prefix that best matches said bit string of said address of said each data packet, said looking up being effected with reference to said clue of said each data packet.

27. The method of claim 26, further comprising the step of:

- (f) for each forwarding router, constructing a respective hash table in the downstream router, said hash table including an indexed list of possible clues that the downstream router may receive from said each forwarding router.

28. The method of claim 26, further comprising the step of:

- (f) constructing a common hash table in the downstream router, said common hash table including an indexed list of possible clues that the downstream router may receive from any of the forwarding routers.

29. The method of claim 28 wherein said hash table includes a bitmap of size  $d$ , each bit in said bitmap being a lookup flag in said downstream router

30. The method of claim 29 further comprising the steps of:

- (g) upon receipt of said clue in one of said data packets;
  - (i) reading said bit in said bitmap which corresponds to said respective forwarding router of said one data packet
  - (ii) routing said one data packet in accordance with said bit.

31. The method of claim 28 further comprising the steps of:

- (g) for each forwarding router, constructing a respective hash table in the downstream router, said respective hash table including an indexed list of possible clues that the downstream router may receive from said each forwarding router.

32. A method of balancing a work load of a set of routers that exchange data packets, each router sending data packets directly only to a subset of the other routers, each data packet including a header that includes a destination address, comprising the steps of:

- (a) providing each router with a database including a plurality of prefixes; and
- (b) when a first router sends one of the data packets to a second router:
  - (i) looking up, in the database of the first router, said prefix that best matches the destination address of said one data packet; and
  - (ii) attaching to said one data packet a clue that is related to said best matching prefix instructing said second router to send said one data

packet directly to a third router without looking up a best matching prefix.

33. A method of routing a plurality of data packets from a forwarding router to a downstream router in a MPLS network, comprising the steps of:

- (a) providing each data packet with a header including an address, said address including at least one bit string;
- (b) providing the forwarding router with a forwarding database including a plurality of prefixes; and
- (c) for each data packet:
  - (i) looking up, in said forwarding database, said prefix that best matches said bit string of said address of said each data packet;
  - (ii) providing data packets having same said best matching prefixes, a label; and
  - (iii) attaching to said each data packet a clue that is related to said best matching prefix.

34. The method of claim 33 wherein said clue includes said label.

35. A method of routing a plurality of data packets from a forwarding router to a downstream router in a Tag-Switching network, comprising the steps of:

- (a) providing each data packet with a header including an address, said address including at least one bit string;
- (b) providing the forwarding router with a forwarding database including a plurality of prefixes; and
- (c) for each data packet:
  - (i) looking up, in said forwarding database, said prefix that best matches said bit string of said address of said each data packet,
  - (ii) providing data packets having same said best matching prefixes, a tag; and



(iii) attaching to said each data packet a clue that is related to said best matching prefix.

36. The method of claim 35 wherein said clue includes said tag.

37. The method as in claim 1 wherein the forwarding router serves as a routing device in a network selected from the group consisting of TCP-IP, MPLS and Tag-switching.

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